TRI–ASSESSMENT ANALYSIS: AN INNOVATIVE MODEL FOR INQUIRY AND CONFIRMATORY DATA ANALYSIS VIA THE NOVEL TRI–MENTORING MODEL DESIGNED TO MEASURE MENTORING EFFICACY

By

JAMES EDWARD OSLER II

Faculty Member, North Carolina Central University, USA.

ABSTRACT

The aim of this paper is to provide a faculty model for positive mentoring was first explored at an African American Historically Black College and University [or "HBCU"]. The purpose of this paper is to present the mentoring model and an analogous trichotomous data analysis methodology referred to as "Tri–Assessment" that is used to determine the validity of the mentoring experience. The research methodology of the mentoring model measures positive mentoring outcomes and is applicable for measuring mentoring as a whole. The model has its foundations in trichotomy drawing upon the research work of the author who has established the field of "Triostatistics" (Osler, 2014), trichotomous research design (Osler, 2012), and the arena of trichotomous psychometric measurement (Osler, 2013a). This paper is organized into various sections that highlight mentoring history, mentoring at an HBCU, and mentoring measurement through the presented model. The example presented of the "Tri–Mentoring Model" presented has the following results: 1.) Identification of positive mentoring traits and characteristics; 2.) An in-depth and accurate way of measuring the outcomes of any mentoring process (as authentically delivered by the participant experiencing the actual mentoring); and lastly 3.) The categorization of positive mentoring outcomes by using the example of faculty mentoring that took place at a HBCU. The author further recommends that both the "Tri–Mentoring Model" and the "Tri–Assessment" research methodology have the unlimited potential to open new arenas of inquiry and data analysis in the diverse field of mentoring and beyond.

Keywords: African American Males Faculty Experience, Efficacy, Historically Black College and University (HBCU), Measurement, Mentoring, Mentoring Characteristics, Mentoring Elements, Mentoring History, Mentoring Measurement, Mentoring Model, Mentoring Traits, Model, Positive Mentoring, Research Capacity Building, Reliability, Tri–Assessment, Tri–Hypotheses, Tri–Mentoring Model, Trichotomy, Triostatistics, Validity.

INTRODUCTION

Mentoring at Historically Black Colleges and Universities (HBCUs) has served an important role in developing successful students and promoting access to higher education for African Americans when other venues were closed to them. It is important to note for the historical purposes of this particular account, that during their inception, HBCUs were far from equal in terms of infrastructure, resources, and operating budgets; these inequities persist to the present day (Anderson, 1988; Brown & Davis, 2001; Brown, Donahoo, & Bertrand, 2001; Drewry & Doermann, 2004). Despite the lack of resources, HBCUs have a rich legacy of producing leaders in all phases of society. Mentoring has played a vital role in this. Black colleges also provide a rich source of social networks to students, fostering an empowering educational climate (Palmer & Gasman, 2008). The purpose of this narrative is to introduce a measurement

model for mentoring and an associated methodology for determining the efficacy of research inquiry through a novel confirmatory data analysis methodology.

1. Objectives

The overall objective of this paper is to provide a new and novel model for inquiry into the effectiveness of mentoring. The second objective of this narrative is to provide a new and dynamic methodology for confirmatory data analysis in research design and analytics. The third and final objective of this paper is to provide a ready and viable example of how the innovative model and its associated novel confirmatory data analysis methodology can be used to analyze and measure non-traditional areas and arenas of research (such as mentoring).

2. Key Terms and Definitions Related to Tri–Assessment and Tri–Mentoring

The following terms aid in the overall comprehension Tri–Assessment and Tri–Mentoring as presented in the sections that follow.

HBCU: An acronym for "Historically Black College & Universities" (U.S. Department of Education, 2008).

Mentoring: A developmental partnership through which one person shares knowledge, skills, information, and perspective to foster the personal and professional growth of someone else (American Speech-Language-Hearing Association [ASHA], 2007a, p. 1 and Wright-Harp & Cole, 2008).

Research Capacity Building: Defined as the collaboration between higher education faculty at an institution of learning that can be interdisciplinary and cross disciplinary bounds to create novel opportunities to conduct and publish research that previously did not exist.

Tri–Assessment: The Triostatistical "Trichotomous Assessment" research methodology that uses presuppositions at the research outset (in the form of "Trichotomous Hypotheses") to determine the overall outcome of a research investigation via confirmatory data analysis.

Tri–Hypotheses: A Triostatistics methodology that are "Trichotomous Hypotheses" that are used to confirm research outcomes as positive; negative; or non-existent.

Tri–Mentoring Model: Trichotomous Mentoring Model is a Triostatistically-based statistical research model that can be used to determine the overall efficacy of the mentoring process from the categorical outcomes identified by the mentee/protégé.

Trichotomy: The term "Trichotomy": is pronounced ['trahy-kot-uh-mee'], spelled "trichotomy", and is a noun with the plural written form "trichotomies". "Trichotomy" has the following threefold definition: (1) Separation or division into three distinct parts, kinds, groups, units, etc.; (2) Subdivision or classification of some whole into equal sections of three or "trifold segmentation"; and (3) Categorization or division into three mutually exclusive, opposed, or contradictory groups, for example – "A trichotomy between thought, emotions, and action" (Osler, 2012).

Triostatistics: (or more simply "Triostat") is the application of Post Hoc measures to the outcomes of the Trichotomous Squared Test. As a statistical discipline Triostat concerns the development and application of specific and uniquely designed advanced Post Hoc statistical tests, methodologies, and techniques. Triostat is used to further investigate the research outcomes from initially statistically significant Tri–Squared Tests. Research studies that analyze data through the use of the Trichotomous Squared Test are the foundation for Triostatistics. Thus, Triostatistics is the further investigation and precise in–depth study of the dynamic data that is the statistically significant Tri–Squared Test results (Osler, 2014).

3. Background

Inquiry into research regarding mentoring may lead one to ask "Exactly what is Mentoring?" and furthermore, "Where does the term 'Mentoring' come from?" As such, a careful observation of research into mentoring as field comprehensively provides a more complete definition for the term: "Mentoring". "Mentoring" is thusly defined by the author in this narrative in the following series of sequential statements:

- Mentoring is a dynamic and interactive process that occurs between two persons for the distinct purposes of growing and developing an individual;

- The Mentor is the one person in this process can be

considered to be "an elder" or a "wise teacher" who is the disseminator of wisdom and knowledge, and

- The recipient of the aforementioned wisdom and knowledge is therefore referred to as the "Mentee" or the receiver of said wisdom and knowledge for the sole purpose of substantive growth and development.

The scientific counseling organization ASHA (the "American Speech–Language–Hearing Association) a professional association for speech–language pathologists, audiologists, and speech, language, and hearing scientists in the United States and international community provides its own definition of "Mentoring". Mentoring (according to ASHA) may be defined as "a developmental partnership through which one person shares knowledge, skills, information, and perspective to foster the personal and professional growth of someone else" (American Speech-Language-Hearing Association [ASHA], 2007a, p. 1 and Wright-Harp & Cole, 2008).

Researchers Wright-Harp & Cole provide a comprehensive look into the unique and manifold history of mentoring of mentoring in their 2008 research article entitled, "A Mentoring Model for Enhancing Success in Graduate Education". Wright-Harp & Cole state the following regarding mentoring in higher education, "Although mentoring has been used extensively in business and medicine to cultivate an individual's career success, only recently has it been employed in graduate education as a mechanism to guide an individual's academic development with the goal to enhance retention and program completion, particularly with regard to males and minorities" (Wright-Harp & Cole, 2008). Wright-Harp & Cole (2008) further state, "The term mentoring, a derivative of the word "mentor," has been described as having its origins in Greek mythology (Roberts, 1999).

4. The History of Mentoring

According to Greek literature, Pallas Athena, who transformed herself into an elderly man known as Mentor, became a servant to King Odysseus (a.k.a. Ulysses), King of Ithaca (National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 1997).

Odysseus entrusted Mentor with the care of his son, Telemachus, when he set out on an odyssey to fight in the Trojan War (Wright-Harp & Cole, 2008). During his absence, Odysseus left both his son and his kingdom in Mentor's care (Reh, 2007; Roberts, 1999). Thus, Mentor became Odysseus' wise and trusted counselor as well as a tutor to Telemachus.

From a historical perspective, the earliest recorded mentor was Imhotep (2635–2595 BC), whose name means "the one who comes in peace." Imhotep (Greek Imouthes) was an Egyptian polymath or "Renaissance man" (Kemp, 2005, p. 159) and served as great vizer (Chancellor) to King Djoser, who ruled as pharaoh during the 3rd Dynasty (Oakes & Gahlin, 2003). One of the world's most famous ancients, Imhotep was the first known architect, physician, scribe, chief lecturer, priest, and astronomer. As master architect to Djoser, he is credited with designing and being responsible for building the Step Pyramid complex at Saqqara, Egypt. For 3000 years, Imhotep was worshipped as a god in Greece and Rome. His titles included Chancellor of the King of Lower Egypt, First after the King of Upper Egypt, Administrator of the Great Palace, Hereditary Nobleman, High Priest of Heliopolis, Builder, Chief Carpenter, and Chief Sculptor (Kemp, 2005). Thus, as master in a number of fields as well as the chief lecturer of Egypt, Imhotep would indisputably be considered the first mentor (Wright-Harp & Cole, 2008). Thus, from the earliest origins in Africa the notion of mentoring has been an intrinsic part of African American heritage and culture. As such, it can be readily seen that the mentoring tradition is prevalent and a part of the ongoing culture of HBCUs.

5. The Mentoring Experience

Mentoring is the act of providing guidance and support delivered from a mentor to a protégé. Most often a senior colleague provides support, feedback, information, and advocacy to a more junior or less experienced colleague (Thomas, Willis, and Davis, 2007). Peer mentoring and upward mentoring (when junior colleagues inform senior colleagues about their needs and experiences), are other mentoring configurations. Mentoring often involves career socialization, inspiration and belief in each other,

and promoting excellence and passion for work through guidance, protection, support, and networking. This is particularly true at an HBCU where nurturing is at the forefront of the culture. The vast majority of HBCUs had their start in Christian Churches were nurturing and development is an ongoing part of the cultural ethos. Thus, it is natural that HBCUs (which are deemed a vital and vibrant resource for the African American communities in which they diversely represent, coexist, are a part of, and serve) openly working in and around professional development through mentoring.

The mentoring process also typically involves taking an interest in each other as human beings as well as supporting professional practice (Vance, 2002). Most definitions of mentoring agree that mentoring goes beyond mere career development but includes a strong personal relationship (Thomas, Willis, and Davis, 2007). Most models of mentoring discuss it as having both instrumental and psychosocial functions (Thomas, 2005). The psychosocial function relates mainly to issues of helping and support whereas the instrumental functions are more likely career related and can involve advocacy, assistance with negotiating the political climate of one's institution, feedback, and access to networks (Thomas, Willis, and Davis, 2007). This in fact is vital to the culture of HBCUs which draw upon positive interaction to create a climate that is very familial. Torrance (1984) describes mentoring relationships as deep and caring. Mentors are close, trusted colleagues, and guides to their protégés, Thomas, Willis, and Davis (2007) state. They go on to say the following: "the mentor–protégé relationship forms over time and becomes something of great value to both the mentor and protégé" (Thomas, Willis, and Davis, 2007). Wilde and Schau (1991) found that graduate students rate mutual support and comprehensiveness of relationship as two of the most important factors in successful mentoring. Mutuality was defined as having a reciprocal relationship where both mentor and protégé share feelings and values.

5.1 The Foundational Example that Led to the Tri–Mentoring Model

The author drew the categories that are reflected in the model presented in this paper from his own experiences with faculty mentoring at an HBCU. The outcomes of a mentoring process are best described from mentee/ protégé who experiences the outcomes from mentoring and can best describe what transpired and how it affected them in the long run. This is very similar to medical testing of novel medicinal procedures or remedies that require the outcome from the patient perspective. Though the doctor (or medical expert) may prescribe and administer the solution, its efficacy is determined by the outcome detailed by the recipient and the observation of the outcome and how it impacts their respective lives.

It is this vein that the author through his own mentoring experiences drew the outcomes that became the various elements and components of the "Tri–Mentoring Model". Experiences that were highly impactful, knowledgeable, and wise greatly aided in the author's faculty preparation in the area of teaching, created unprecedented opportunities in the area of research (or scholarly activity), and extended partnerships that led to outstanding collaboration in the area of service (in forms of advising and professional development as well). The three trichotomous areas of teaching, research and service are the basic requirements for "Tenure and Promotion" in the hallowed halls of academia. They must be sufficiently addressed and often succeeded when one wishes to remain viably employed in any institution of higher education. Thus faculty disseminated expertise (teaching); faculty "pushing the body of knowledge" (research); and faculty extensive outreach to the community and globe (service) are the "de facto" base from which merit is decided and longevity is determined. New faculty are often unaware of the culture within their units that require guidance if they are to be successful. This is why faculty mentoring plays such a vital role in new faculty success. Someone has to guide the new faculty member much like a swimming instructor has to guide a new swimmer. Once they have the basics and can navigate the waters on their own, their likelihood of success becomes exponential. Furthermore, they are more willing to guide and mentor others, especially if their

own mentoring experience was very positive.

The author received exquisite mentoring from a seasoned faculty member who is both knowledgeable and experienced. The results can be seen in professional growth and subsequent academic success. The mentor himself had the following qualities that were inputted into the entire mentoring process:

- Engagement;
- Empowerment; and
- Efficacy.

As a result the outcomes as output of the mentoring process were:

- Communication;
- Collaboration; and
- Connection.

All the aforementioned categories were behaviors that exhibited the best in the mentoring process. The author noticed that these "behavioral qualities" as inputs and outputs were trichotomous and ultimately led to a model that could be measured. This became a model for measure mentoring efficacy as a means of "Research Capacity Building" that was a collaborative adaptive model developed by the author and his mentor to create opportunities for research within their mutual unit (the School of Education at the HBCU). Measurement is the hallmark of "Research Capacity Building" and when reflecting on the outcomes of his own mentoring experience the author created a model for measuring mentoring that ultimately became "The Tri–Mentoring Model" presented in this paper.

6. Research Methodology: Triostatistics and Trichotomous Research Design

6.1 The Foundations Tri–Mentoring Model

The "Research Capacity Building Positive Mentoring Model" espoused in this paper has its foundations in both the "Concept pertaining to and the Mathematical Law of Trichotomy". To develop a keener understanding of the "Trichotomous Mentoring Model" (or "Tri–Mentoring Model") one must first grasp the notion of "trichotomy". The term "Trichotomy" is pronounced ['trahy-kot-uh-mee'],

spelled "trichotomy", and is a noun with the plural written form "trichotomies". "Trichotomy" has the following threefold definition:

- Separation or division into three distinct parts, kinds, groups, units, etc.;
- Subdivision or classification of some whole into equal sections of three or "trifold segmentation"; and
- Categorization or division into three mutually exclusive, opposed, or contradictory groups, for example – "A trichotomy between thought, emotions, and action" (Osler, 2012).

The conceptualization of a "trichotomy" is not new. Research in this area was conducted by Pioneers such as Immanuel Kant who espoused a description of the term in his philosophical contemplations. The "Concept of Trichotomy" is grounded in "The Mathematical Law of Trichotomy" and is defined as follows: The foundational idea of a "Trichotomy" has a detailed long history that is based in discussions surrounding higher cognition, general thought, and descriptions of intellect. Philosopher Immanuel Kant adapted the Thomistic acts of intellect in his trichotomy of higher cognition — (a) Understanding; (b) Judgment; and (c) Reason (which he correlated with his adaptation in the soul's capacities as) — (a) Cognitive Faculties; (b) Feeling of Pleasure or Displeasure; and (c) Faculty of Desire (Teo, 2005).

"The Mathematical Law of Trichotomy" is defined by Sensagent (2012), Osler (2013b), and Singh (1997) as follows: "It is important to note that in mathematics, the law of trichotomy is most commonly the statement that for any (real) numbers x and y, exactly one of the following relations holds. Until the end of the 19th century, the law of trichotomy was tacitly assumed true without having been thoroughly examined (Singh, 1997). A proof was sought by Logicians and the law was indeed proved to be true. If applied to cardinal numbers, the law of trichotomy is equivalent to the axiom of choice. More generally, a binary relation R on X is trichotomous if for all x and y in X exactly one of xRy, yRx or x = y holds (Osler, 2013b). If such a relation is also transitive it is a strict total order; this is a special case of a strict weak order. For example, in the

case of three elements the relation R given by: (1) aRb; (2) aRc; and (3) bRc is a strict total order; while the relation "R" given by the cyclic "aRb, bRc, cRa is a "non–transitive trichotomous relation" (Sensagent, 2012). In the definition of an ordered integral domain or ordered field, the law of trichotomy is usually taken as more foundational than the law of total order, with y = 0, where 0 is the zero of the integral domain or field. In set theory, trichotomy is most commonly defined as a property that a binary relation "<" has when all its members "<x, y>" satisfy exactly one of the relations listed above. Strict inequality is an example of a trichotomous relation in this sense. Trichotomous relations in this sense are irreflexive and antisymmetric (Sensagent, 2012)".

6.2 The Science of "Triostatistics"

Triostatistics (or more simply "Triostat") is the application of Post Hoc measures to the outcomes of the Trichotomous Squared Test. As a statistical discipline Triostat concerns the development and application of specific and uniquely designed advanced Post Hoc statistical tests, methodologies, and techniques. Triostat is used to further investigate the research outcomes from initially statistically significant Tri–Squared Tests. Research studies that analyze data through the use of the Trichotomous Squared Test are the foundation for Triostatistics. Thus, Triostatistics is the further investigation and precise in–depth study of the dynamic data that is the statistically significant Tri–Squared Test results (Osler, 2014).

The word "Triostatistics" is a portmanteau of the terms: "Triochotomous" and "Statistics"; that can also be referred to as "Triostat", "Advanced Trichometrics" or "The Science of Trichometry". More definitively Triostatistics is a branch of the science statistics that is the specific application of statistical methods, techniques, and strategies to a wide range of topics that are concern the Tri–Squared Test. At the heart of this statistical discipline is the application of the mathematical "Law of Trichometry". The science of Triostatistics encompasses the design of Tri–Squared experiments, especially in education and social behavioral settings. However, the utility and flexibility of Triostat as a body statistical metrics allows it to be applied to a variety of sciences (through the use and application of the mathematical "Law of Trichotomy"). Triostatistics as a discipline is the collection, summarization, and analysis of data from Tri–Squared experiments; and the interpretation of, and inference from, statistically significant Tri–Squared Test results (Osler, 2014). The Tri–Mentoring Model and the associated Tri–Assessment Data Analysis technique are both forms of Triostatistics.

6.3 The Tri–Squared [Tri²] Mathematical Model

Tri–Squared is grounded in the combination of the application of the research of two mathematical pioneers and the author's research in the basic two dimensional foundational approaches that ground further explorations into a three dimensional Instructional Design (Osler, 2012). The aforementioned research includes the original dissertation of optical pioneer Ernst Abbe who derived the distribution that would later become known as the chi square distribution and the original research of mathematician Auguste Bravais who pioneered the initial mathematical formula for correlation in his research on observational errors. The Tri–Squared research procedure uses an innovative series of mathematical formulae that do the following as a comprehensive whole: (1) Convert qualitative data into quantitative data; (2) Analyze inputted trichotomous qualitative outcomes; (3) Transform inputted trichotomous qualitative outcomes into outputted quantitative outcomes; and (4) Create a standalone distribution for the analysis possible outcomes and to establish an effective-research effect size and sample size with an associated alpha level to test the validity of an established research hypothesis (Osler, 2012).

The process of designing instruments for the purposes of assessment and evaluation is called "Psychometrics". Psychometrics is broadly defined as the science of psychological assessment (Rust & Golombok, 1989). The Tri–Squared Test pioneered by the author, factors into the research design a unique event–based "Inventive Investigative Instrument" (Osler, 2012). This is the core of the Trichotomous–Squared Test. The entire procedure is grounded in the qualitative outcomes that are inputted as Trichotomous Categorical Variables based on the Inventive Investigative Instrument (Osler, 2013a). Osler

(2012) initially defined the Tri–Squared mathematical formula in the Journal on Mathematics article entitled, "Trichotomy–Squared – A novel mixed methods test and research procedure designed to analyze, transform, and compare qualitative and quantitative data for education scientists who are administrators, practitioners, teachers, and technologists" as follows: $Tri^2 = T_{sum}[(Tri_x - Tri_y)^2 : Tri_y]$. The Tri–Squared Model (in tabular format) and its associated calculations, definitions, procedures are explained in detail on the pages that follow.

7. Modeling the Standard Tri^2 3×3 Table and its Corresponding Calculations

Table 1 follows and illustrates the "Tri^2 Mathematical Model" illustrated in tabular format.

There are a number of Triostatistical metrics and tests that can provide additional information on statistically significant Tri–Squared research investigations that can greatly enhance the understanding of initial research results. The Post Hoc use of Triostatistics on statistically significant Tri–Squared Test data provides a plausible statistical measure that allows investigators to further interpret the in–depth and rich complexities of Tri–Squared research data. The wide spread use of these measures will push the body of knowledge in research fields and make the field of statistics more approachable and plausible (Osler, 2014). Table 2 follows and provides the Tri–Mentoring Model Table.

7.1 The Tri–Mentoring Model Results

Table 2 describes the application of the Trichotomous Mentoring Model six factors as in-depth mentoring qualitative outcomes to determine the efficacy faculty HBCU mentoring.

The Trichotomous Mentoring Model or ("Tri–Mentoring Model") illustrates the interactivity and engagement exhibited by the author and his faculty mentor at the southern HBCU. The Model is presented in a Trichotomous Three by Three Table designed to illustrate how the major six factors of the mentoring process were displayed by the faculty mentor and the interactions of these outcomes are presented in trichotomous outcomes (as Yes; No; or None) in the table. The Trichotomous Mentoring Model Input Factors are: Engagement= Is defined as the effective active correspondence by the mentor with the mentee; Empowerment= Is defined as the ability of the mentor to instill in the mentee a strong sense of self-worth (i.e., "value"), self-control (i.e., instill a sense of security and environmental stability), and self-growth (to both see and access the present and future implications of their work); and Efficacy= Is defined as the outcome of mentoring process that actively results in mentee success (in external academic obligations, such as teaching, research, and service). The 3 × 3 Table has the following Trichotomous Mentoring Model Output Factors: Communication = Defined here as the ability of the faculty mentor and mentee to actively share verbally; Collaboration = Defined here as the ability of the faculty mentor and mentee to work together beneficially on some project or research endeavor; and Connection = Defined here as

Table 1. Tri–Squared Test 3 × 3 Table Calculations: Explaining How the Tri^2 Statistical Mathematical Model is Constructed Displaying the 3 × 3 Table Calculation Values of Qualitative Outcomes of the Tri–Squared Test

TRICHOTOMOUS MENTORING MODEL:
[INPUT FACTORS: BY MENTOR]

TRICHOTOMOUS MENTORING MODEL:[OUTPUT FACTORS: BY MENTEE/PROTÉGÉ]		Engagement	Empowerment	Efficacy
	Communication	Yes	Yes	Yes
	Collaboration	Yes	Yes	Yes
	Connection	Yes	Yes	Yes

Table 2. Trichotomous Mentoring (or "Tri–Mentoring") Model Table

the ability of the faculty mentor and mentee to equally "see eye to eye" on a variety of topics, concepts, and/or ideas. The Trichotomous Mentoring Model as it applies to the author's time spent with his mentor is as follows:

Table 2 illustrates the Trichotomous Mentoring Model has a 3 × 3 Standard Table based upon the "Mathematical Law of Trichotomy". The Model has the following possible trichotomous outcomes = Positive ("+") [as "Yes"]; Negative ("−") [as "No"]; or Non-Existent ("⊘") [as "None"]. The cross sector of each input and output factor yields an outcome by the mentee/protégé to determine the overall efficacy of the mentoring process. The nine possible trichotomous outcomes of "measured mentoring" are determined in the following manner using cross tabulation:

Column One = Input Factors + Output Factors yields the following (as determined by the mentee/protégé):

Tri–Mentoring Cross Tabulation: Trichotomous Response Outcome:

Engagement + Communication   = Yes; or No; or None

Engagement + Collaboration   = Yes; or No; or None

Engagement + Connection   = Yes; or No; or None

Column Two = Input Factors + Output Factors yields the following (as determined by the mentee/protégé):

Tri–Mentoring Cross Tabulation: Trichotomous Response Outcome:

Empowerment + Communication = Yes; or No; or None

Empowerment + Collaboration   = Yes; or No; or None

Empowerment + Connection   = Yes; or No; or None

Column Three = Input Factors + Output Factors yields the following (as determined by the mentee/protégé):

Tri–Mentoring Cross Tabulation: Trichotomous Response Outcome:

Efficacy + Communication = Yes; or No; or None

Efficacy + Collaboration   = Yes; or No; or None

Efficacy + Connection   = Yes; or No; or None

Table 2 data displays the outcomes from the author as a sample of the outstanding mentoring that he has received as a faculty member in the School of Education at North Carolina Central University (an HBCU). Through cross tabulation (that is the intersection between mentoring input factors and the mentoring output factors) of the respondent (as the determined mentee/protégé) can provide either: 1.) Quantitative data ([as either a 1 (for a positive), −1 (for a negative), or a 0 response (for a neutral)] for the purposes of quantitative triostatistical trichotomous measurement); 2) symbols ([as either a "+" (for positive), a "−" (for negative), or a "⊘" (for a neutral or non-existent)] for the purposes of ambiguity), or qualitative output [as a "Yes"; "No"; or a "None" as indicated in Table 3] to determine the overall efficacy of the mentoring process. Similarly the same Tri–Mentoring Model can be used to measure mentoring as a process to determine overall efficacy by any individual who has been involved in mentoring. Idealistically, the model is universal and is applicable and can be used to measure: 1) Faculty Mentoring; 2) Staff Mentoring; and 3) Student Mentoring. The sample data in Table 2 provides an exemplary example of a mentoring measurement model that exhibits the positive traits and characteristics that can be found in positive African American male faculty mentoring at an HBCU.

8. Research Design using the Tri–Mentoring Model

The sample data previously illustrated can be used to

clarify and present an ideal mentoring research design. This design can be qualitative (using the aforementioned Tri–Mentoring Model language as "Yes"/"No"/"None" or the parallel previously presented symbols as Positive ("+") [as "Yes"]; Negative ("–") [as "No"]; or Non-Existent ("⊘") [as "None"]) or purely quantitative data (using the aforementioned integers "0; –1; or a 1" as indicators of "non-effective" to "ideal efficacy"). It is important to note that the "Standard Trichotomous 3 × 3 Table" in this instance can be used as a hypothetical Tri–Mentoring Model hypothesis structure as a method of quantifying the qualitative outcomes of the mentoring process to determine overall mentoring efficacy. Quantitative conversion of the Tri–Mentoring Model data into integers will enable a researcher in this area to use a Tri–Squared Test (Osler, 2012) like data analysis procedure via a Table of Tri–Mentoring associations as a definitions index (see Table 3) to determine research outcomes using standard statistical confirmatory data analysis procedures based upon the calculated strength of. Using the sample data provided as a baseline that is an ideal example of mentoring rectilinear stochastic optimization (in terms of the linear presuppositions that are represented in the respective trichotomous input and output factors).

Calculated Score as a Measure of Overall Trichotomous Mentorship Efficacy	Tri-Mentoring Score Definition Index
Score = "9"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Ideal Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "8"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Consistent Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "7"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Regular Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "6"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Semi-Regular Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "5"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Moderate Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "4"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Semi-Moderate Mentoring Relationship between Mentor and Mentee/Protégé
Score = "3"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Minimal Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "2"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Early Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "1"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Initiating Positive Mentoring Relationship between Mentor and Mentee/Protégé
Score = "0"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Non-Existent Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-1"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Initiating Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-2"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Early Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-3"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Minimal Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-4"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Semi-Moderate Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-5"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Moderate Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-6"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Semi-Regular Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-7"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Regular Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-8"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Consistent Negative Mentoring Relationship between Mentor and Mentee/Protégé
Score = "-9"; Based upon the Tri–Mentoring Mathematical Calculation: $\Sigma[x_{Input} + y_{Output}]$ for All 3 ×3 Table$_{[Rows + Columns]}$	Ideal Negative Mentoring Relationship between Mentor and Mentee/Protégé

Table 3. Measurement of Mentoring Efficacy using the Tri–Mentoring Model Scoring Table

This will also allow for researcher development of Tri–Mentoring psychometric instruments as testing tools designed to as certain mentoring efficacy. This is very similar to linear stochastic modelling in terms of psychometric instrument testing (as it pertains to the intersections between the input and output factors in this example) that are also mentioned as applications that are applied in a variety of disciplines (such as digital signal processing, instructional design, data optimization testing as well as a host of others). The Table used to analyze in detail the Tri–Mentoring analysis for overall efficacy of a specified mentoring relationship based upon trichotomously categorized input and output factors as trifold Cartesian Coordinates during a set time is presented in Table 3.

Interpreting the level of "Trichotomous Mentoring" (via summative x and y Input and Output Factors) as the "Tri–Mentoring Model Reliability and Validity Scoring Index" based upon the Tri–Mentoring Model Integer Calculation:

Table 3 displays the mentoring efficacy associations (by definition) calculated using the computational "Tri–Mentoring Mathematical Scoring Formula" as the "Tri–Mentoring Model Integer Calculation":

$\Sigma[x_{Input} + y_{Output}]$; and (further defined as)

$\Sigma[x_{Input} + y_{Output}]$ for All 3×3 Table$_{[Rows + Columns]}$.

The calculation "$\Sigma[x_{Input} + y_{Output}]$" is provided to quantify the mentoring, the results of mentoring as a process, and determine its overall efficacy. To do this, scores must be converted into raw data that can then be analyzed. Using the Tri–Mentoring Model mathematical integers ("0; –1; or a 1") as input and output factors the scores listed above can then be calculated and then examined via definition to determine the final comprehensive efficacy score for mentoring as a process. As such, Table 3 "Tri–Mentoring Mathematical Scoring Formula" adds together all nine cells of the 3 by 3 Tri–Mentoring Table that intersects the input and output factors (based upon the aforementioned neutral/negative or positive mathematical integers) to achieve the final holistic Tri–Mentoring score (that has a corresponding meaning in the "Tri–Mentoring Score Definition Index").

9. The Novel Tri–Mentoring Model of Tri–Assessment using Tri–Hypotheses for Innovative Confirmatory Data Analysis

The research design structure of the Tri–Mentoring Model has a specific "Trichotomous Assessment" or "Tri–Assessment" statistical "confirmatory data analysis" (or "CDA") methodology used to determine the validity of a presupposition regarding a specified mentoring process. Tri–Assessment uses "Trichotomous Hypotheses" or "Tri–Hypotheses" based off of the mentoring researchers initial assumption or "presupposition" of the outcomes of the mentoring between the mentor and the mentee/ protégé. The Tri–Assessment model of CDA uses three trichotomous presuppositions parallel to more traditional research hypotheses. These three possible research outcomes are: 1) The "Archithesis" (using the Latin prefix "Arch" or "Archi" meaning "ideal") which is equivalent to the initial research hypothesis; 2) The "Antithesis" or opposite of the Archithesis which is equivalent to the null hypothesis; and 3) The "Anathesis" (using the Latin prefix "An" or "Ana" meaning "empty" or "none") which is equivalent to a vacant or a "non-hypothesis" that is a non-effect or lack of any observational occurrence that is neither the Archithesis or the Anathesis. Idealistically, the research investigator has some expectation of how the research will shed light. This is the foundation of the traditional CDA methodology. In the Tri–Assessment model, the outcomes are trichotomous meaning the final result will be either positive, negative, or neither of the two. As such the associated "Trichotomous Research Questions" that ultimately become the following:

1) Does the entire mentoring experience provide the mentee/protégé with an overall outlook and final set of outcomes that are viewed as positive?

2) Does the entire mentoring experience provide the mentee/protégé with an overall outlook and final set of outcomes that are viewed as negative?

3) Does the entire mentoring experience provide the mentee/protégé with an overall outlook and final set of outcomes that are viewed as having neither positive nor negative final results (viewed as a "neutral" final out come)?

In terms of traditional hypothesis testing, the Tri–Assessment model mathematically parallels the "Trichotomous Research Questions" by procedurally changing the questions into the Tri–Assessment trichotomous pre suppositions by using the following (1a) to (3a) final format:

1a) Research Question 1 thereby becomes equal to the Alternative Hypothesis $[H_a]$ = Research Hypothesis $[H_1]$ = Archithesis (positive) = $[A_{[+]} = A_1]$;

2a) Research Question 2 thereby becomes equal to the Null Hypothesis $[H_0]$ = Research Null Hypothesis $[H_0]$ = Antithesis (negative) = $[A_{[-]} = A_2]$; and lastly

3a) Research Question 3 thereby becomes equal to the Non-Hypothesis [no mathematical format equivalent] = Anathesis (none) = $[A_{[\otimes]} = A_3]$.

The hypothetical hypothesis Tri–Mentoring Model 3 by 3 mathematical structure can now be tested to determine the overall mentoring process efficacy (as defined within the confines of a specific inquiry into the identified input and output factors) using the Tri–Assessment methodology to confirm or refute the initial research presupposition as outlined by the mentoring research investigator. Thus, the Tri–Assessment Tri–Hypotheses Testing methodology is presented in initial research format for the Tri–Mentoring Model as follows:

A_1: There is significant evidence that confirms or provides support for the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution as indicated by an overall comprehensive score in the range of "1 to 9" as calculated by the $\Sigma[x_{Input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

A_2: There is no significant evidence that neither confirms or provides support for the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution as indicated by an overall comprehensive score in the range of "–1 to –9" as calculated by the $\Sigma[x_{Input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

A_3: There is non-existent evidence that neither confirms nor provides support against the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution as indicated by an overall comprehensive score of "0" as calculated by the $\Sigma[x_{Input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

Due to the aforementioned, the Tri–Assessment Tri–Hypotheses Testing methodology is presented in confirmatory data analysis associated mathematical format for the Tri–Mentoring Model as follows:

A_1: $A_{[+]}$ = 1 to 9; or

A_2: $A_{[-]}$ = –1 to –9; or

A_3: $A_{[\otimes]}$ = 0.

10. Implications of the Tri–Assessment Model as Confirmatory Data Analysis Outcomes

The outcomes of the Tri–Mentoring Model by the author yielded the following results according to the established research Tri–Assessment Tri–Hypotheses:

A_1 [Accepted]: There is significant evidence that confirms or provides support for the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution as indicated by an overall comprehensive score in the range of "1 to 9" as calculated by the $\Sigma[x_{Input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

A_2 [Rejected]: There is no significant evidence that neither confirms or provides support for the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution as indicated by an overall comprehensive score in the range of "–1 to –9" as calculated by the $\Sigma[x_{Input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

A_3 [Rejected]: There is non-existent evidence that neither confirms nor provides support against the existence of a positive outcome in the overall scoring by the mentee/protégé in regards to the length of time that they were mentored by senior faculty at the identified institution

as indicated by an overall comprehensive score of "0" as calculated by the $\Sigma [x_{input} + y_{Output}]$ for all 3 × 3 Table$_{[Rows+Columns]}$ in the Tri–Mentoring Model.

As such, the Tri–Assessment Tri–Hypotheses Testing methodology confirmatory data analysis associated mathematical format for the Tri–Mentoring Model is as follows:

$A_1 : A_{[+]} = 9;$

$A_2 : A_{[-]} = -1 \text{ to } -9;$ or

$A_3 : A_{[\emptyset]} = 0.$

Thus, the sample data research outcomes are shown to be statistically viable in terms of the specified faculty mentoring at a HBCU. The positive mentoring outcome yielded a final comprehensive calculated final overall value of "9" = an "Ideal Positive Mentoring Relationship between Mentor and Mentee/Protégé" on the "Tri–Mentoring Scoring Index" (Note: "$A_1 : A_{[+]} = 9$"). This is a positive indicator that further investigations conducted under the same conditions will most likely yield further positive results. The initial research investigation presented holds that the sample data on faculty mentoring for professional development is positive in terms of perceptions of self–growth in the areas teaching, research, and service. The result of the sample data research also provides a good foundation for further inquiry into the same (or similar) researchable areas in regards to mentoring.

The research outcomes indicate that in terms of faculty mentoring that the guidance that the author received from his faculty mentor at the HBCU was overwhelmingly positive and productive. The evidence presented through the Tri–Mentoring Model illustrates that there exists: 1) An "ideal" or "high level" in regards to "Communication", "Collaboration", and "Connection" between the mentor and the mentee/protégé; 2) As a result of the ideal Communication, "Collaboration", and "Connection" the mentee/protégé experienced an ideal level of "Engagement", also felt an extraordinary level of understanding as "Empathy"; and as a direct result of this 3) The overall mentoring process had an extremely high level of "Efficacy". The implications for the Tri–Mentoring

Model and its associated Tri–Assessment methodology are quite vast in the academy. This type of mentoring research can be readily replicated and adapted to many other situations and scenarios thereby providing administrators and leaders with data and evidence that actively supports mentoring (particularly faculty mentoring) in institutions of higher learning.

11. Discussion Regarding the Solutions, Recommendations, and Future Implications of Tri–Mentoring Model and Associated Tri–Assessment Data Analysis Technique

The results of the sample data provided from the author's own faculty mentoring experience are consistent with other research in the field (see Conclusion). Future research in the area should focus on larger institutions with more diverse populations to provide a broader spectrum of data pertaining to the use of faculty mentoring. Investigations in this area can lead institutions of higher education to create better mentoring procedures that truly reflect their intrinsic populations (and thereby provide a girth of information regarding the overall efficacy of the mentoring process). Such data could provide educators and administrators the grounds for meeting the needs of their learners in a rapidly changing educational environment.

The author therefore recommends the following in deference to the information provided in this paper:

- That more research be conducted with model and hypothesis testing method to substantiate its overall applicability to a variety of research formats;

- An assortment of psychometric research test instruments can be developed to use the "Tri–Mentoring Model" and "Tri–Assessment" analytical technique in a variety of research approaches and research disciplines to see if the dual or solo methodologies yield new arenas of application beyond the traditional uses of the model and analysis technique in inquiry; and

- That the researchable applications and discoveries regarding this particular model (and associated "Tri–Hypotheses" analytical measure) are documented so that the novel research innovations

can be readily applied to support mentoring as a whole both now and in the future.

Summary and Conclusion

The efficacy of the "Tri–Mentoring Model" is confirmed in the sample data results presented in the detailed account provided by the author in an earlier section of the narrative. The utility of the "Trichotomous Mentoring Model" and its associated "Tri–Assessment" confirmative data analysis hypothesis testing methodology hereby allow a "mentee/protégé" or a "mentoring researcher" to critically analyze all of the various aspects of the mentoring process to determine its overall: a) viability; b) verifiability; and c) validity in terms of 'within' "categorical clusters" based on the overall beneficial elements and components of mentoring.

In addition, the "Tri–Mentoring Model" and "Tri–Assessment" data analysis technique can aid in the process of determining how to best conduct research on mentoring that is both qualitative and quantitative. As such, this makes the mentoring a valuable researchable resource that can now be analyzed through a variety of statistical metrics and measures. As "Data-Driven Decision-making" has come to the forefront of analysis in academia. Tools and procedures that can both quantify and explain the complexity of an in-depth collaborative process such as mentoring are much needed and very necessary. This ultimately insures that arenas that once appeared to be unmeasurable such as mentoring now have value that can (through the Tri–Mentoring Model procedure) be precisely analyzed, rigorously studied, meticulously reported, and are carefully considered before they are scrutinized and deemed unnecessary or non-valuable. Thus, the "Tri–Mentoring Model" is a dynamic and effective tool that adds comprehensively valid and verifiable value to the arena of mentoring and the field of Triostatistics as a whole.

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ABOUT THE AUTHOR

Dr. James Edward Osler II is currently a faculty member in the School of Education (SOE) at North Carolina Central University (NCCU). He is an artist, has been a K–12 teacher, is an active researcher, an innovative technologist, Osler is also the author of many influential refereed Journal articles, Books, and papers on topics as diverse as:1) "Applied Educational Science"; 2) "Inventive Instructional Design"; 3) "Empowering Neuro mathematics Concepts"; 4) "Algorithmic Online Learning"; 5) "Innovative Statistical Methods"; 6) "Novel Fields of Learning"; and 7) "Ideal Technology Engineering". He is a licensed North Carolina (NC) Preacher, K–12 Art Educator, and Instructional Technology Specialist with a Technology Endorsement. Dr. Osler is also certified in digital literacy, research, and visual programming. He has served on multiple refereed journal review boards and has authored graduate-level degree and certificate programs. North Carolina State University (NCSU) has recognized him as one of its 100 Most Influential Black Alumni. He has received three of the highest and most respected honors at NCCU: "The Employee Recognition Award for Outstanding Service"; "The University Award for Teaching Excellence", and the first "Chancellor's Award for Innovation". He is also the recent recipient of the 2017 IGI Global Outstanding Scholars Award; 2017 Registry in Marquis Who's Who, and the 2017 COGIC (Church of GOD in Christ) Black History Achievement Award.